PAPER SOLUTION

From Meerut

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29	2nd

Aryan Agarwal
Founder and CEO
CVPS INTEGRATED STAR COURSE

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Rank Predictor

Question Paper

#Q. The equation $\alpha x + \beta y = 109$ is chord of ellipse $\frac{x^2}{9} + \frac{y^2}{4} = 1$ having midpoint $\left(\frac{5}{2}, \frac{1}{2}\right)$, then $\alpha + \beta$ is

$T = S_1$

$$\frac{xx_1}{9} + \frac{yy_1}{4} = \frac{x_1^2}{9} + \frac{y_1^2}{4}$$

$$\frac{x \cdot 5}{18} + \frac{y \cdot 1}{8} = \frac{25}{36} + \frac{1}{16}$$

$$\frac{20x + 9y}{72} = \frac{100 + 9}{144} = \frac{109}{144}$$

$40x + 18y = 109$

$\alpha = 40, \beta = 18.$

$\alpha + \beta = 58.$

Ans. (58)

#Q. If $\lim_{t\to 0}\left(\int_0^1 (3x+5)^t dx\right)^{\frac{1}{t}} = \frac{a\left(\frac{8}{5}\right)^{\frac{p}{q}}}{4e}$, then α is

(A) 64

(B) 8

(C) 16

(D) 32

$$\left[\frac{(3x+5)^{t+1}}{3(t+1)}\right]_0^1$$

$$\lim_{t\to 0}\left(\frac{8^{t+1}-5^{t+1}}{3(t+1)}\right)^{\frac{1}{t}}$$

$$= e^{\lim_{t\to 0}\left[\frac{8^{t+1}-5^{t+1}-3t-3}{3(t+1)t}\right]}$$

$$= e^{\lim_{t\to 0}\left[\frac{8^{t+1}\ln 8 - 5^{t+1}\ln 5 - 3}{3[2t+1]}\right]}$$

$$= e^{\frac{8\ln 8 - 5\ln 5 - 3}{3}}$$

$$= e^{\frac{1}{3}\ln\left[\frac{8^8}{5^5}\right]-1} = \left(\frac{8^8}{5^5}\right)^{\frac{1}{3}}\cdot\frac{1}{e}$$

$$\left(\frac{8^8}{5^5}\right)^{\frac{1}{3}} \cdot \frac{1}{e}$$

$$\frac{8^{2/3} \cdot 8^{8/3} \left(\frac{1}{5}\right)^{5/3}}{4e}$$

$$= \frac{\left(\frac{8}{5}\right)^{5/3} \cdot 8^{5/3}}{4e}$$

$$\frac{a\left(\frac{8}{5}\right)^{9/2}}{4e}$$

$$a = 8^{5/3}$$

$$\boxed{a = 32}$$

Ans. (D)

#Q. If $log\ y = x\ log\frac{2}{5}, x \in \mathbb{N} \cup \{0\}$, Then sum of all values of y equals to

(A) $\frac{8}{3}$

(B) $\frac{5}{4}$

(C) $\frac{2}{3}$

(D) $\frac{5}{3}$ ✓

$\log y = x \log \frac{2}{5}$

$\log y = \log \left(\frac{2}{5}\right)^x$

$\boxed{y = \left(\frac{2}{5}\right)^x}$

$\text{Sum} = 1 + \frac{2}{5} + \left(\frac{2}{5}\right)^2 + \cdots$

$= \frac{1}{1 - \frac{2}{5}} = \frac{1}{3/5}$

$= \frac{5}{3}$.

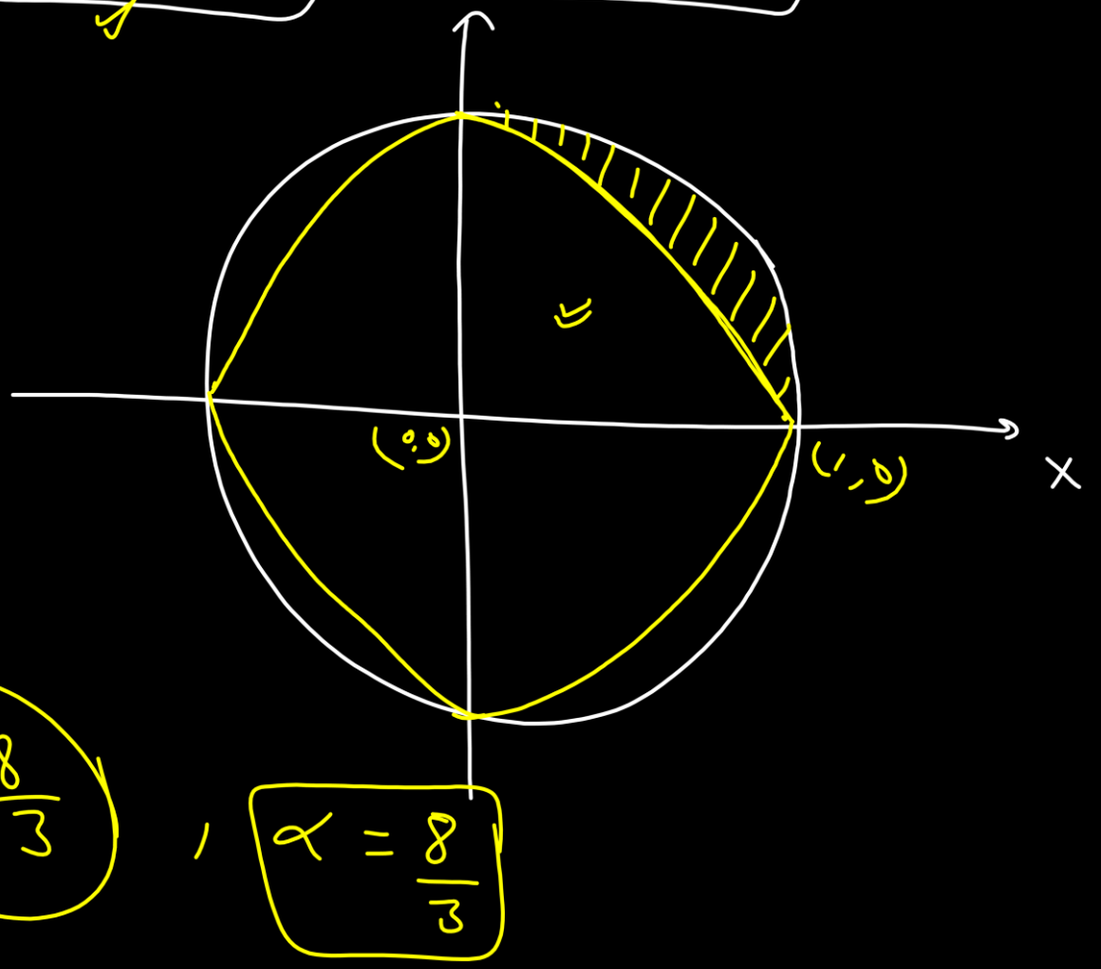
Ans. (D)

#Q. Area enclosed between the curves $|y| = 1 - x^2$ and $x^2 + y^2 = 1$ is $(\pi - \alpha)$ sq. units, then 9α is

(A) 24
(B) 32
(C) 16
(D) 8

$y = 1 - x^2, \quad y > 0$

$y = x^2 - 1, \quad y < 0.$



$$\pi - 4\int_0^1 (1 - x^2)\,dx$$

$$\pi - 4\left[x - \frac{x^3}{3}\right]_0^1$$

$$\pi - 4\left[1 - \frac{1}{3}\right] = \pi - \frac{8}{3}$$

$\alpha = \frac{8}{3}$

Ans. (A)

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#Q. Two points $(4, 2)$ *and* $(0, 2)$ lie on the circle whose centre lies on $3x + 2y + 2 = 0$, then length of chord whose mid-point is $(1, 2)$, is

$6 + 2y + 2 = 0$

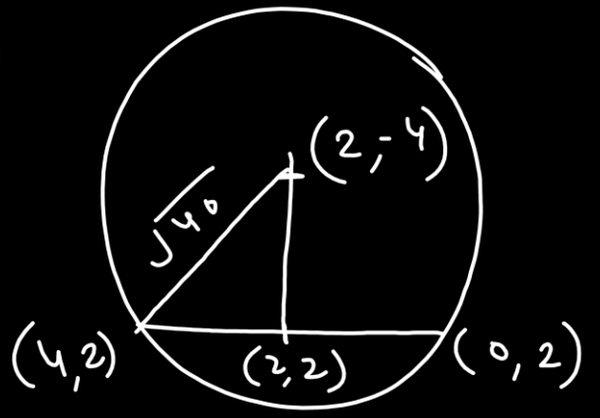
$y = -4$

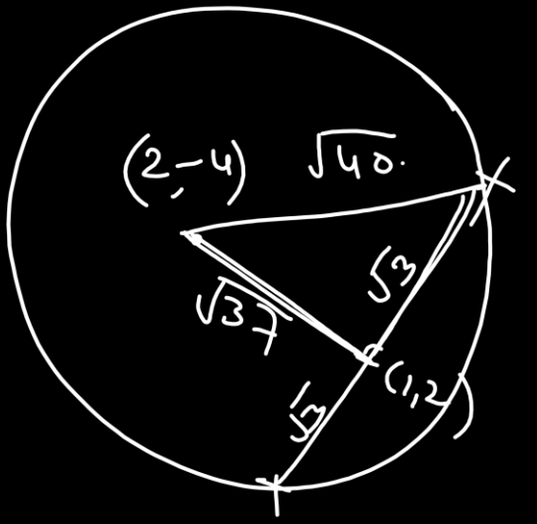
(A) $\sqrt{5}$

(B) $2\sqrt{3}$

(C) $2\sqrt{5}$

(D) $\sqrt{3}$





Ans. (B)

#Q. If α, β are the values of m where

$x + y + 2z = 1$

$x + 2y + 4z = m$

$x + 4y + 8z = m^2$ have infinitely many solutions. Then $\sum_{n=1}^{10}(n^{\alpha} + n^{\beta})$ is equal to

$y + 2z = m - 1$

$2y + 4z = m^2 - m$

$m^2 - m = 2m - 2$

$m^2 - 3m + 2 = 0$

$m = 1, 2.$

$$\sum_{n=1}^{10}(n^1 + n^2)$$

$$= \left(\frac{n(n+1)}{2} + \frac{n(n+1)(2n+1)}{6}\right)_{n=10}$$

$$= 55 + \frac{10 \times 11 \times 21}{6}$$

$$= 55 \times 8 = 440$$

Ans. (440)

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#Q. The value of $\int_0^{\frac{\pi}{4}} \left(sin\left|\left(4x-\frac{\pi}{2}\right)\right| + sin\,[2x]\right) dx$ is (where $[\cdot]$ denotes the greatest integer function)

$0 < 2x < \pi/2 \Rightarrow 2x = 1$

$$\int_0^{\pi/8} \sin\left(\pi/2 - 4x\right)dx + \int_{\pi/8}^{\pi/4} \sin\left(4x - \pi/2\right)dx + \int_0^{\frac{1}{2}} 0\,dx + \int_{\frac{1}{2}}^{\pi/4} \sin 1\,dx$$

$$\int_0^{\pi/8} \cos 4x\,dx - \int_{\pi/8}^{\pi/4} \cos 4x\,dx + \sin 1\left(\frac{\pi}{4} - \frac{1}{2}\right)$$

$$\frac{1}{4}\left(\sin 4x\right)_0^{\pi/8} - \frac{1}{4}\left(\sin 4x\right)_{\pi/8}^{\pi/4} + \left(\frac{\pi-2}{4}\right)\sin 1$$

$$\frac{1}{4}\left[1 - 0 - (0-1)\right] + \left(\frac{\pi-2}{4}\right)\sin 1 = \boxed{\frac{1}{2} + \left(\frac{\pi-2}{4}\right)\sin 1}$$

(A) $\frac{1}{2} + \left(\frac{\pi-2}{4}\right) sin1$

(B) $\frac{1}{4} + \left(\frac{\pi-2}{2}\right) sin1$

(C) $\frac{1}{2} - \left(\frac{\pi-2}{4}\right) sin1$

(D) $\frac{1}{4} - \left(\frac{\pi-2}{2}\right) sin1$

Ans. (A)

#Q. If the domain of $log_{x-1}\left(\frac{2x^2-9x+4}{x^2-4x+5}\right)$ is (α, ∞) and $log_5(18x - x^2 - 77)$ is (β, γ), then the value of $\alpha^2 + \beta^2 + \gamma^2$ is

$(4, \infty)$ $\qquad$ $(7, 11)$

$x-1>0$ & $x-1\neq 1$

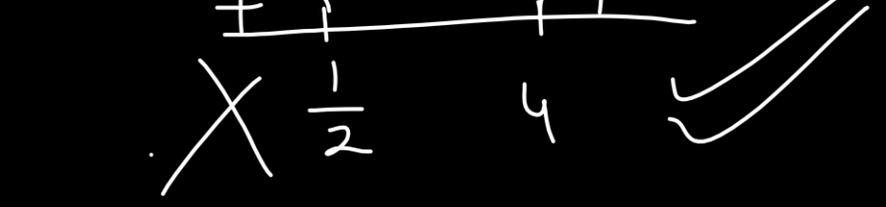
$x>1$

$\frac{2x^2-9x+4}{x^2-4x+5} > 0$

$2x^2-8x-x+4$

$2x(x-4)-1(x-4)$

$(2x-1)(x-4)>0$



$\alpha^2+\beta^2+\gamma^2$

$16+49+121$

$= 186$

$18x - x^2 - 77 > 0$

$x^2 - 18x + 77 < 0$

$(x-7)(x-11) < 0$

$(7, 11)$

Ans. (186)

#Q. Let $f(x)=\int_0^x t(t^2-3t+20)dt, x\in(1,3)$ and range of $f(x)$ is (α,β), then $\alpha+\beta$ is equal to

A. $\frac{185}{4}$

B. $\frac{185}{2}$ ✓

C. $\frac{185}{3}$

D. $\frac{37}{4}$

$f'(x)=x(x^2-3x+20)>0$.

f is inc.

$\alpha=f(1)=\int_0^1(t^3-3t^2+20t)dt$

$=\left[\frac{t^4}{4}-t^3+10t^2\right]_0^1$

$=\frac{1}{4}-1+10=\frac{1}{4}+9$

$=\frac{37}{4}$

$\beta=f(3)=\int_0^3(\quad)dt$

$=\frac{81}{4}-27+90$

$=\frac{81}{4}+63$

$\alpha+\beta=\frac{37}{4}+\frac{81}{4}+63$

$=\frac{118}{4}+63$

$=\frac{59}{2}+63=\frac{185}{2}$

Ans. (B)

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#Q. The value of the limit

$$\lim_{x\to 0}(cosec\ x)\left(\sqrt{2cos^2x+3cos\ x}-\sqrt{cos^2x+sin\ x+4}\right)\ is$$

(A) 1

(B) 0

(C) $-\frac{1}{2\sqrt{5}}$ ✓

(D) $\frac{1}{2\sqrt{5}}$

$$\lim_{x\to 0}\frac{\cos^2x+3\cos x-\sin x-4}{(\sin x)\left(\sqrt{5}+\sqrt{5}\right)}$$

$$=\lim_{x\to 0}\frac{-2\cos x\sin x-3\sin x-\cos x}{\cos x\,(2\sqrt{5})}$$

$$=-\frac{1}{2\sqrt{5}}$$

Ans. (C)

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#Q. Let the line L be $\frac{x-1}{1}=\frac{y-4}{3}=\frac{z-7}{5}$ and foot of perpendicular from $(1,-2,-1)$ to L is (α,β,γ), then $\alpha+\beta+\gamma$ is

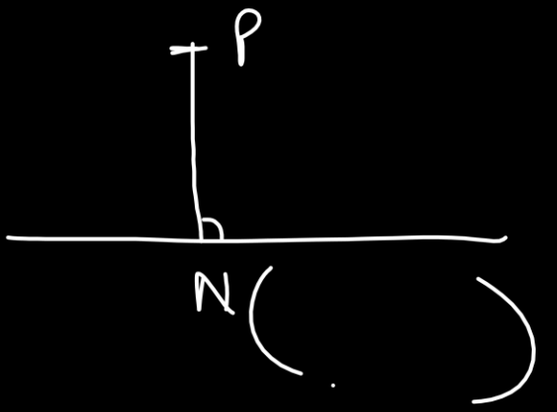
0 $\quad -18 \quad -40$

$$\frac{x-1}{1}=\frac{y-4}{3}=\frac{z-7}{5}=\frac{1(1-1)+3(-2-4)+5(-1-7)}{1+9+25}$$

$$\frac{x-1}{1}=\frac{y-4}{3}=\frac{z-7}{5}=-\frac{58}{35}$$

$$\frac{x+y+z-12}{9}=-\frac{58}{35}$$

$$x+y+z=12-\frac{9\times 58}{35}$$



A $-\frac{102}{35}$ ✓

B $\frac{69}{35}$

C $\frac{102}{35}$

D $-\frac{69}{35}$

Ans. (A)

#Q. If the set of exhaustive values of a for which the equation $2x^2 + (a-5)x + 15 = 3a$ ha no real roots is (α, β), $then$ $|4(\alpha+\beta)|$ is equal to

A 18

B 54

C 52

D 56 //

$D < 0$.

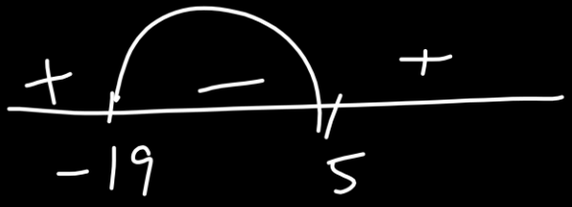
$B^2 - 4AC < 0$.

$(a-5)^2 - 4(2)(15-3a) < 0$

$a^2 - 10a + 25 - 120 + 24a < 0$

$a^2 + 14a - 95 < 0$

$(a+19)(a-5) < 0$



$-19 < a < 5$.

$\alpha = -19$, $\beta = 5$

$4(\alpha+\beta) = 4(-14)$

$= -56$.

Ans. (D)

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#Q. $a_1, a_2, a_3, \ldots, a_{2024}$ are in A.P

$a_1 + (a_5 + a_{10} + a_{15} + .. + a_{2020}) + a_{2024} = 2233$ then $a_1 + a_2 + a_3 + .. + a_{2024} = ?$

$1 \times 5, 2 \times 5, 3 \times 5, \ldots, 404 \times 5$

$202(a_5 + a_{2020}) + (a_1 + a_{2024}) = 2233$

$203(a_1 + a_{2024}) = 2233$

$a_1 + a_{2024} = 11$

$1012[a_1 + a_{2024}]$

$= 1012 \times 11$

$= 11132$

A. 11111

B. 11132

C. 11133

D. 11134

Ans. (B)

#Q. Let $a_{ij} = (\sqrt{2})^{i+j}, A = [a_{ij}]_{3\times 3}$ If sum of third row of A^2 *is* $\alpha + \beta\sqrt{2}$ *, then* $\alpha + \beta$ is

$$A^2 = \begin{bmatrix} 2 & 2\sqrt{2} & 4 \\ 2\sqrt{2} & 4 & 4\sqrt{2} \\ 4 & 4\sqrt{2} & 8 \end{bmatrix} \begin{bmatrix} 2 & 2\sqrt{2} & 4 \\ 2\sqrt{2} & 4 & 4\sqrt{2} \\ 4 & 4\sqrt{2} & 8 \end{bmatrix}$$

$$= \begin{bmatrix} & & \\ & & \\ 8+16+32 & 8\sqrt{2}+16\sqrt{2}+32\sqrt{2} & 16+32+64 \end{bmatrix}$$

$8+16+32 = 56$

$8\sqrt{2}+16\sqrt{2}+32\sqrt{2} = 56\sqrt{2}$

$16+32+64 = 112$

$168 + 56\sqrt{2}$

$\alpha + \beta = 168 + 56$

$= 224$

(Ans.224)

#Q. If 3^{107} is divided by 23, then remainder is

Ans. (6)

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#Q. If the letter of the word "KANPUR" are arranged in dictionary, then the 440th word is

A, K, U

A, K, N, P, R, U

(A) → 5! = 120
(K) → 5! = 120
(N) → 5! = 120
} 360

PA → 4! = 24
PK → 4! = 24
PN → 4! = 24
} 72

PRA → 3! = 6

PRK ANU

PRKAUN → 440th

A. PRKUNA

B. PRKNAU

C. PRKUAN

D. PRKAUN

Ans. (D)